

CONTRACT NO. DABT60-90-D-0010
DELIVERY ORDER 0017

A D H O C
T E C H N I C A L R E P O R T

**AH-1F COBRA REWIRE PROGRAM
MANPRINT ANALYSIS**



Submitted on:

31 AUGUST 1994

Submitted to:

**U.S. Army Training and Doctrine Command (TRADOC)
ATTN: ATCA
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19941227 018

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments, regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 31 August 1994	3. REPORT TYPE AND DATES COVERED AD HOC Technical Report (CDRL A007)	
4. TITLE AND SUBTITLE AH-1F COBRA Rewire Program MANPRINT Analysis		5. FUNDING NUMBERS C #DABT60-90-D-0010	
6. AUTHOR(S) Clarke, Robert A. Boltralik, William J.			
7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES) AEPCO, Inc. 15800 Crabs Branch Way, Suite #300 Rockville, MD 20855-2622		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAMES(S) AND ADDRESS(ES) U.S. Army Training & Doctrine Command (TRADOC) ATTN: ATCA Fort Eustis, VA 23604-5538		10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Distribution Statement A: Approved for Public Release; Distribution is Unlimited		12b. DISTRIBUTION CODE 10041927132	
13. ABSTRACT (Maximum 200 words) The purpose of this analysis was to review and analyze the AH-1F Cobra Rewire Program from a MANPRINT perspective. This was accomplished through examination of the AH-1F Cobra Rewire Program documentation and its technical publication, the Cobra Helicopter Rewire Manual (CHRM). Review of this program's documentation was conducted to identify MANPRINT deficiencies and develop corrective recommendations that ensure the CHRM would mitigate these shortcomings. The scope of this effort was primarily confined to the AH-1F Cobra Rewire Program's CHRM. Inputs to the CHRM were received from the AH-1 Cobra Project Management Office (PMO), Army aviation maintenance facilities, fielded AH-1F Cobra units, and Korean Air Lines (KAL). Government Furnished Information (GFI) and Contractor Furnished Information (CFI) from KAL were received in a fairly timely manner. Total integration of all AH-1F Cobra Rewire Program acquisitions efforts was beyond the scope of the delivery order.			
14. SUBJECT TERMS Manpower & Personnel Integration (MANPRINT) Cobra Helicopter Rewire Manual (CHRM) Korean Air Lines (KAL)		15. NUMBER OF PAGES 8	16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT

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AD HOC TECHNICAL REPORT

AH-1F COBRA REWIRE PROGRAM MANPRINT ANALYSIS

CDRL A017, Delivery Order 0017

Army Contract No. DABT60-90-D-0010

31 August 1994

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Justification _____	
Classification /	
Security Codes	
DTA	Avail and/or Special
A-1	

AD HOC TECHNICAL REPORT

AH-1F COBRA REWIRE PROGRAM MANPRINT ANALYSIS

1.0 INTRODUCTION

1.1 Background

The Cobra weapon system preceded the development and production of the AH-64 Apache, OH-58D Kiowa Warrior, and the RAH-66 Comanche. The Cobra helicopter continues to perform admirably in day and night, with the Cobra Night Sight (M65/C-NITE) modification, in attack and reconnaissance roles, even though AH-1 Cobra technology is well over 20 years old. Cobra helicopters still have a vital role in the nation's attack helicopter requirements in future years.

Based on guidance and direction contained in the September 1993 Aviation Restructure Initiative (ARI), AH-1 Cobra attack helicopters will remain in the active U.S. Army fleet until the year 2010. The current active Army AH-1F fleet consists of 495 aircraft. Cobra weapon systems also comprise a substantial aviation slice of the U.S. Army National Guard aircraft fleet. In consonance with guidance contained in the ARI, approximately 313 AH-1Fs will be eventually transferred to Army National Guard aviation attack units, leaving 182 AH-1F's in the active Army.

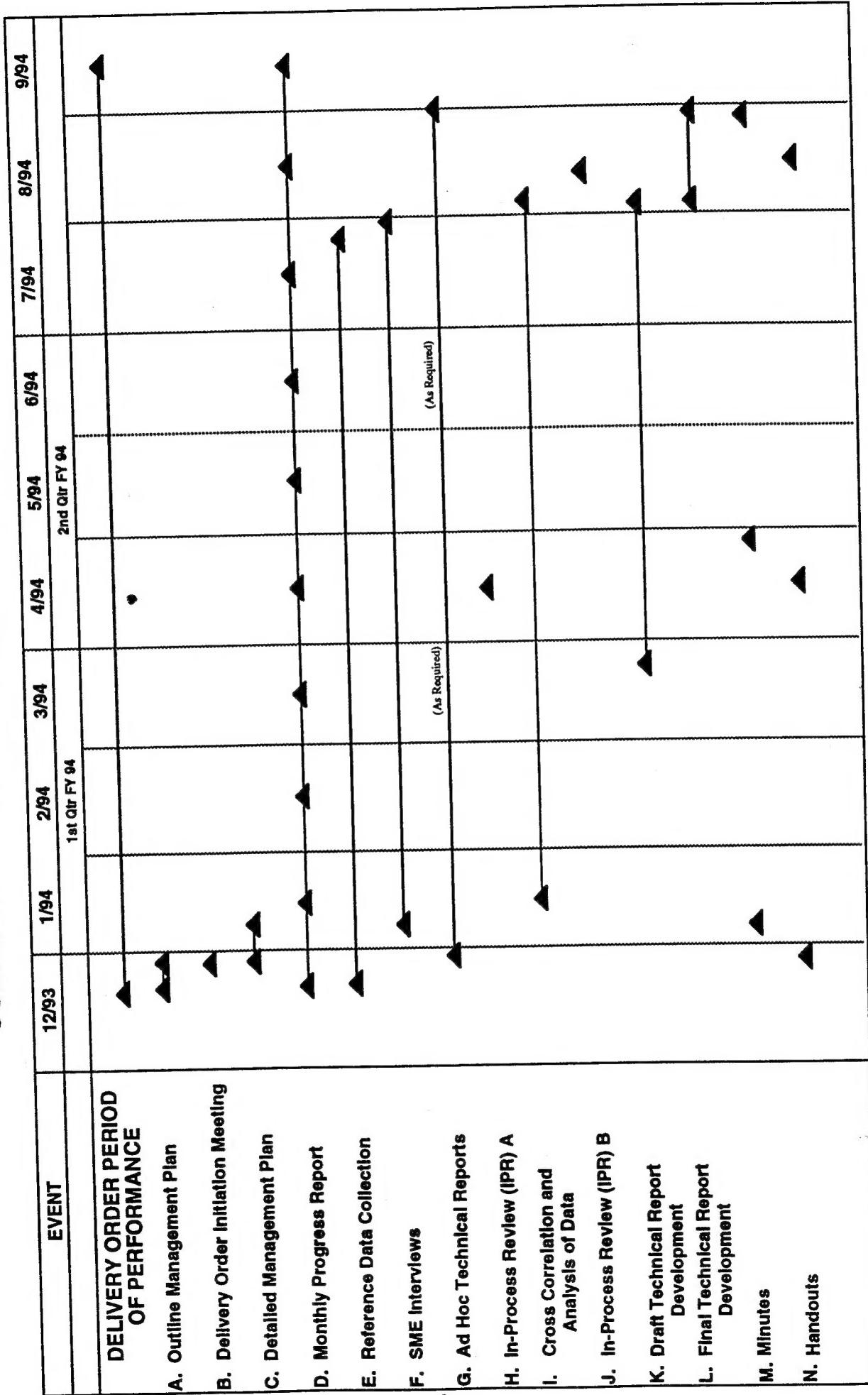
Cobra systems' safety, reliability, and maintainability need to be enhanced for long-term use by active Army, National Guard, and Reserve aviation units and activities. With the current Department of Defense announcements slowing the pace of modernization and reducing the defense budget, it becomes critically important to accomplish reliability and maintainability upgrades, via technology insertion, into all AH-1s. Additionally, the aircraft commands a significant part of the ATCOM Directorate of International Logistics (DIL) Foreign Military Sales (FMS) program.

1.2 Purpose and Objectives

The purpose of this analysis was to review and analyze the AH-1F Cobra Rewire Program from a MANPRINT perspective. This was accomplished through examination of the AH-1F Cobra Rewire Program documentation and its technical publication, the Cobra Helicopter Rewire Manual (CHRM). Review of this program's documentation was conducted to identify MANPRINT deficiencies and develop corrective recommendations that ensure the CHRM would mitigate these shortcomings. Figure 1 provides an overview of the delivery order's schedule and milestones.

The specific issues to be resolved by this MANPRINT analysis will include the following:

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COBRA REWIRE PROGRAM MANPRINT ANALYSIS**



△ SCHEDULED DATES
▲ ACTUAL DATES

Figure 1

- (a) What are the potential MANPRINT impacts of not incorporating reliability and maintainability upgrades to the aging AH-1F fleet?
- (b) **Manpower:** How will the manpower requirements be effected as the Cobra field units are deactivated and AH-64 Apache units are fielded?
- (c) **Personnel:** How will downsizing the active Army AH-1 fleet effect the already trained active Army AH-1 Aviators? What flight training, skills, knowledge and abilities (SKAs) will be required for the already trained Cobra pilots as AH-1 units are deactivated?
- (d) **Training:** How will downsizing the active Army Cobra helicopter fleet effect flight and maintenance personnel and training requirements? Are AH-1 Cobra Flight Weapons Simulators (FWS) still technologically adequate to train aviators in mission requirements through the next decade?
- (e) **Health Factors Engineering (HFE):** Are appropriate ergonomic, anthropometric, and other HFE concerns and considerations addressed in solicitations or Modification Work Orders (MWOs) to insure the equipment will be safe to operate?
- (f) **System Safety:** What safety issues/considerations must be investigated to insure the AH-1 continues to be a safe aircraft to operate and maintain?
- (g) **Health Hazards:** Are appropriate health hazard specifications and standards for Government and industry adequately addressed in MWO requirements, to ensure that the aircraft will be safe to operate and maintain?

1.3 Scope

The scope of this effort was primarily confined to the AH-1F Cobra Rewire Program's CHRM. Inputs to the CHRM from the AH-1 Cobra Project Management Office (PMO), Army aviation maintenance facilities, fielded AH-1F Cobra units, and Korean Air Lines (KAL). Government Furnished Information (GFI) and Contractor Furnished Information (CFI) from KAL were received in a fairly timely manner. Total integration of all AH-1F Cobra Rewire Program acquisition efforts was beyond the scope of the delivery order.

2.0 SYSTEM DESCRIPTION

2.1 AH-1F Cobra Attack Helicopter

The U.S. Army AH-1F Cobra attack helicopter is a tandem seat, 2 place (pilot and copilot/gunner), single engine, aerial weapons platform. The Cobra helicopter is used in support of military units as a gunship, with its primary mission as anti-armor, but it can also be used in close air support and air-to-air roles. Typical armament systems for the AH-1F Cobra consist of: (8) Tube-Launched, Optically-sighted, Wire-guided (TOW) missiles; (2) 2.75 in. Folding-Fin Aerial Rocket (FFAR) pods; and (1) 20mm cannon.

2.2 Affected Aircraft Systems

Currently, it is projected in the Army Aviation Restructure Initiative (ARI), that a total of 132 U.S. Army AH-1F model Cobras will remain in the Active Army's inventory until the aircraft is eventually retired - projected to be by the year 2010. Therefore, only F-model and M65/C-NITE AH-1F model Cobras will be rewired.

2.3 AH-1F Cobra Rewire Program

The Cobra Rewire Program was initiated by the former Cobra Product Manager, LTC Donald S. Burke, Jr., in early 1992, after world-wide visits with all AH-1 Attack Helicopter and AH-1 Air Cavalry units. At that time, deteriorating aircraft Kapton wiring was one of the top pressing logistic and technical issues, creating a great amount of NMC times for the entire fleet. After completing a market survey/study of Government (including Corpus Christi Army Depot) and industry maintenance facilities (OLR sites) capable of building and testing complete aircraft wiring harnesses, it was determined that two facilities, the U.S. Army National Guard Aviation Classification and Repair Activity Depot (MO-AVCRAD), and also Unicor, Inc. (Federal Prison Industries) had the technical expertise to tackle the program. To date, the MO-AVCRAD has built, tested, and shipped 19 wire bundles to Korea, including the specialized M65/C-NITE Forward-Looking Infrared (FLIR) Cobra Night Sight wiring harnesses. The AVCRAD is currently projected to initially build a total of 34 wire bundles. After a longer start-up and testing process, Unicor, Inc. recently delivered its first bundle to the Government. Unicor, Inc. is programmed to build a total of 18 wire bundles.

3.0 TECHNICAL APPROACH

3.1 Methodology

The analysis was initiated by first conducting a detailed review of existing AH-1 Cobra Rewire Program Reports and studies; AH-1 Cobra Rewire Program documentation; facility requirements' repair manuals; operations manuals; Integrated Logistic Support Plans (ILSPs); System Training Plans (STRAPs); Reliability, Availability and Maintainability (RAM) Rationale Reports; specific AH-1 Cobra Rewire Program materiel requirements; program overview materials; selected training publications; AH-1 Cobra Rewire Program maintenance/technical personnel job descriptions; and assorted other materials provided by the Army AVCRD and the Army Aviation and Troop Command (ATCOM).

Also, separate AH-1 Cobra Rewire Program procurement documents were reviewed, analyzed and amended in order to include consideration for MANPRINT. Those results were then consolidated and used as additional reference data by the government and AEPCO in the development of the final CHRM. Figure 2 provides a broad overview of the process flow used for the analysis's technical approach.

**COBRA REWIRE PROGRAM
MANPRINT ANALYSIS TECHNICAL APPROACH
(Delivery Order 0017)**

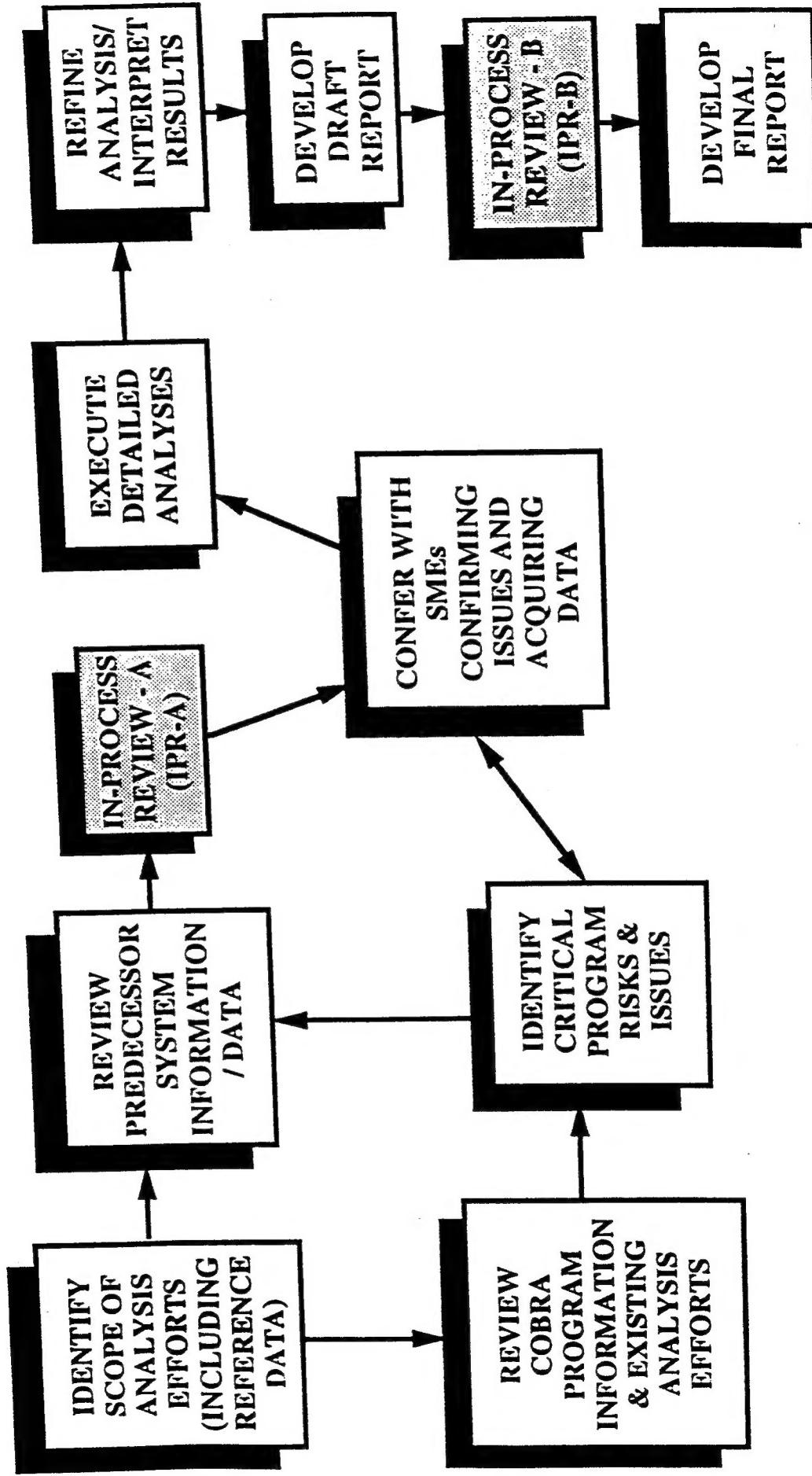


Figure 2

3.2 System Specific Concerns

The use of Kapton wiring was common while the AH-1 Cobra helicopter was still in production. It was latter discovered that the insulation used in Kapton wire breaks down prematurely leading to assorted electrical problems in the aircraft. Many of these difficulties have been system failures of electronic components, many of which were erroneous due to short circuits caused by the aircraft's Kapton wiring system. All of this has lead to considerable drops in aircraft availability rates, large increases in the number of "False Returns" of various electronic components, and increases in the workloads on unit maintenance personnel, as well as added difficulties "troubleshooting" aircraft problems.

The AH-1F Cobra Rewire Program involves the removal of all Kapton wire from the aircraft and replacing it with Tefcel wiring. Major concerns addressed by the action include enhancements in system safety, improved RAM numbers which reduce Manpower, Personnel and Training (MPT) concerns due to decreased maintenance actions, increased Operational Availability (Ao) and Fully Mission Capable (FMC) aircraft, and reductions in Non Mission Capable Supply (NMCS) and Non Mission Capable Maintenance (NMCS) aircraft.

3.3 Subject Matter Experts and Government Furnished Information

The following SMEs were contacted and provided valuable insight in various aspects of the AH-1F Cobra helicopter and its rewire program:

AVCRAD

Mr. Chuck Worley
MO-AVCRAD
2501 Lester Jones Ave.
Springfield, MO 65803-9513

DCMO-KIMHAE (at Korean Air Lines)

SSG L. C. Parker
DCMO-KIMHAE (ATTN: DCMCI-GKK-R)
Unit 2000
APO AP 96214

Cobra Project Manager's Office

MWO Robert Kentner
ATTN: AMCPM-CO-T
4300 Goodfellow Boulevard
St. Louis, MO 63120-1798

4.0 ANALYSIS CONCERNS AND FINDINGS

4.1 Review and Analysis of GFI and CFI

Analysts conducted an extensive review of the wiring related difficulties associated with the AH-1F Cobra helicopter. Not only was Kapton wire the primary cause of these problems causing false removals and replacements of various electronic components, but it showed a strong potential of becoming a safety concern by presenting possibilities of a fire hazard. Although fires directly attributed to Kapton wire were very rare, it is still an area of concern. Line Replaceable Units (LRUs) were also a major source of concern for several reasons. Faulty wiring in the aircraft was leading to "False Returns" and unnecessary removal and replacement of LRUs. This created several difficulties. First, the unit had a drop in Ao because of aircraft not being FMC. Second, there was an increased workload placed on maintenance personnel because of these removals and replacements at the Aviation Unit Maintenance (AVUM) level, as well as at the Aviation Intermediate Maintenance (AVIM) level running tests on LRUs. This also lead to strains on other support personnel in that now more LRUs were required in the logistics system to compensate for the increased number of LRUs in maintenance. These factors all adversely affected the unit's NMCS and NMCM numbers.

With regard to the review, revision, and validation of the CHRM, AEPCO analysts remained in close contact with SMEs at AVCRD and ATCOM, as well as KAL in the Republic of Korea (ROK) who will be supporting the rewiring of Army aircraft in ROK. Of particular concern was the accuracy and thoroughness of the CHRM to ensure the rewiring of aircraft went smoothly. Also, concerns were expressed to ensure that adequately skilled personnel would be available for the actual rewiring of airframes. Analysts were particularly attentive to the specific written procedures and illustrations associated with the wire replacements.

4.2 Findings

Analytical findings regarding the initial development of the CHRM were very revealing. Preliminary drafts of the CHRM were written so that procedures for the rewiring were clear and concise. Some areas showed some inaccuracies, though, regarding procedural sequences and specific tool requirements.

Skill requirements of work force personnel were assessed at AVCRD by analysts and found to be more than adequate to accomplish all necessary removal, replacements, installation, and testing functions associated with the AH-1F Cobra Rewire Program. Reviews were also conducted on the skills, knowledge, and abilities of both U.S. Army civilian personnel and KAL maintenance staff in ROK. Here, too, both were found to be more than capable of accomplishing the tasks of rewiring applicable aircraft.

Thus far, four (4) airframes have been totally rewired by KAL, in Korea, for U.S. Army aviation units. Two (2) additional airframes have been rewired and are

awaiting pickup by the Army aviation units, and two (2) aircraft are currently in work at KAL.

4.3 Recommendations

Specific recommendations regarding the CHRM included some restructuring of procedural sequencing regarding some of the replacement wire harnesses. Also, several modifications to illustrations were required to enhance their accuracy and eliminate any confusion that might have resulted for rewire installation personnel. Special tools were not an issue of concern and listings of required tools for task accomplishment were sufficient.

The AH-1F Cobra Rewire Program will prove to be of enormous benefit to the U.S. Army and should proceed without delay. Not only does it enhance a unit's Ao, it will greatly reduce the workload strain on AVUM and AVIM personnel. Although no detailed Value Engineering Assessment was conducted as part of this analysis, there are undoubtedly significant cost savings that will result from this program.